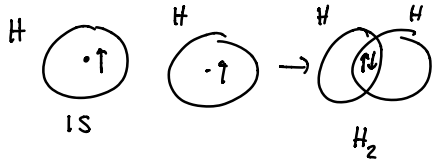
Today: Valence Bond Theo

① Valence Bond (VB) Theory
- quantum mechanics
- describes & explains chemical bonding
- accounts for the shape of molecules.

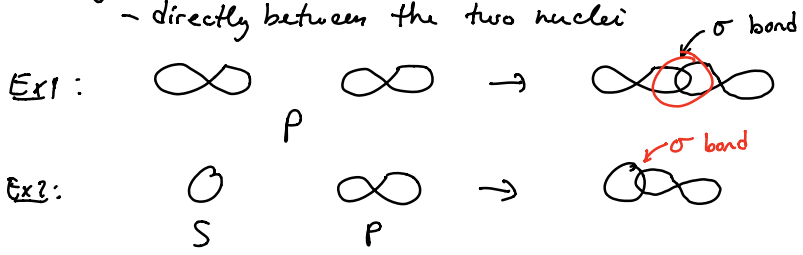
② Guiding principles of VB
- orbital overlap



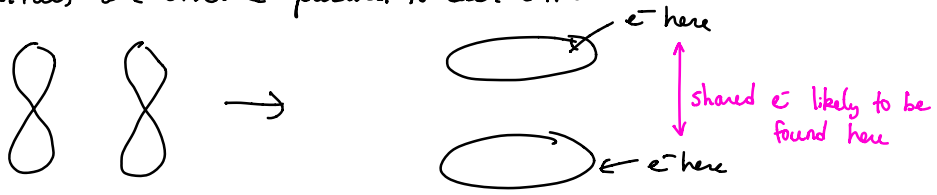
- maximum overlap
- explains observed shapes (VSEPR):
  - process of combining or mixing orbits to form new ones. (hybridization)

③ Mechanism of overlap

ⓐ Sigma bonds (σ)
- directly between the two nuclei

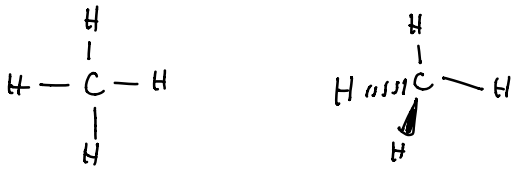


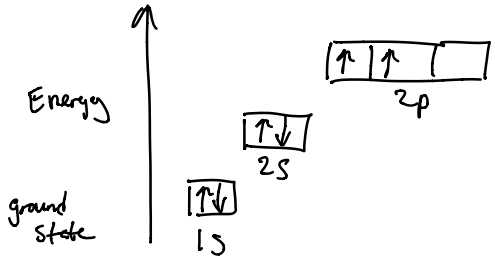
ⓑ Pi bonds (π)
- p orbitals are oriented parallel to each other

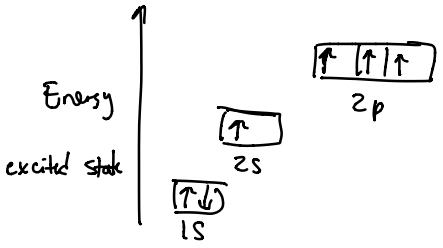


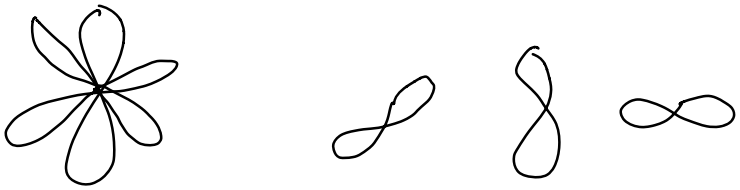
④ Methane

CH_4:



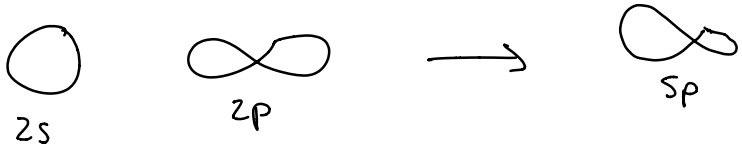






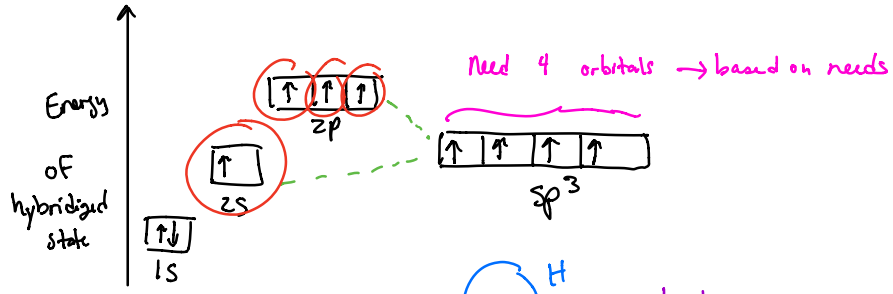
What VB says:

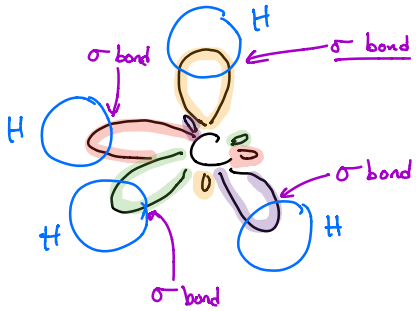
→ The 2s and 2p orbitals will combine/mix to form new orbitals of EQUAL energy.



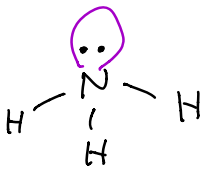
→ with the carbon in methane:

combine $s + p + p + p = sp^3$ orbitals





Ex: NH_3 :

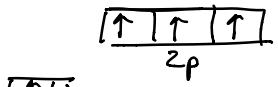


AX_3E_1

4 boxes needed

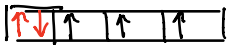
only looking at valence shell.

ground state



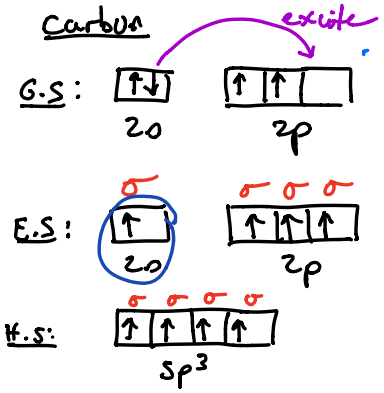
have to be at same energy level (to minimize repulsion

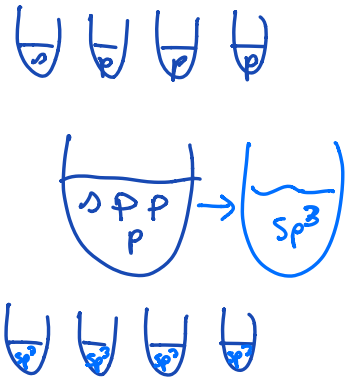
*no need to excite since we already have enough single electron.

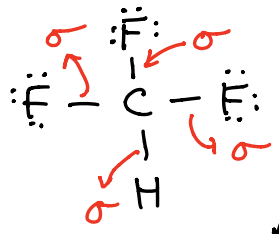


Hybridization Part II

Ex: CHF_3







AX_4E_0

4+0 = 4

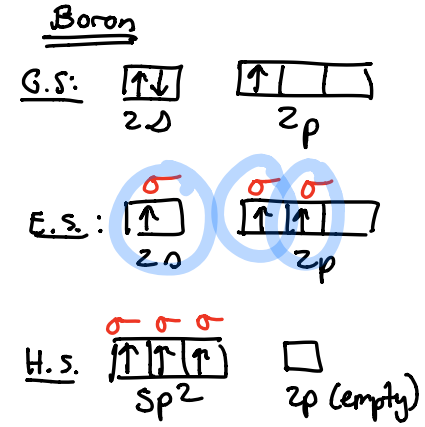
tells us how many hybrid orbitals we need

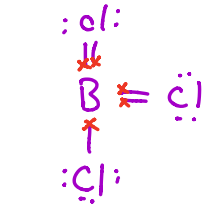
sp^2

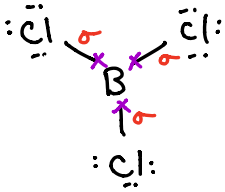
↳ mixing s + p + p (sp^2)

Ex: BCl_3

Total v.e⁻: 24 e⁻

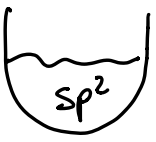






AX_3E_0

3+0 = 3

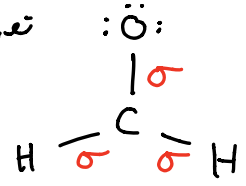


remaining e⁻: 24 − 24 = 0.
(total, used)

} sp^2 solution

Ex: H_2CO

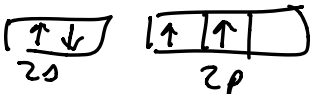
Total: 12 v.e



remaining = 12 − 12 = 0

AX_3

Carbon

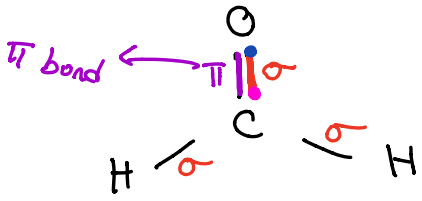
G.S: 

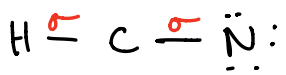
E.S: 

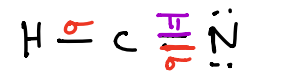
↳ need to mix: s + p + p → sp^2

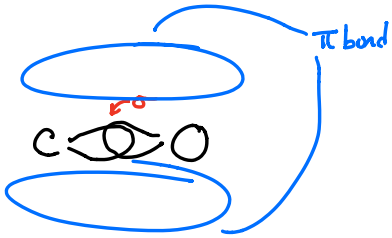
H.S: 

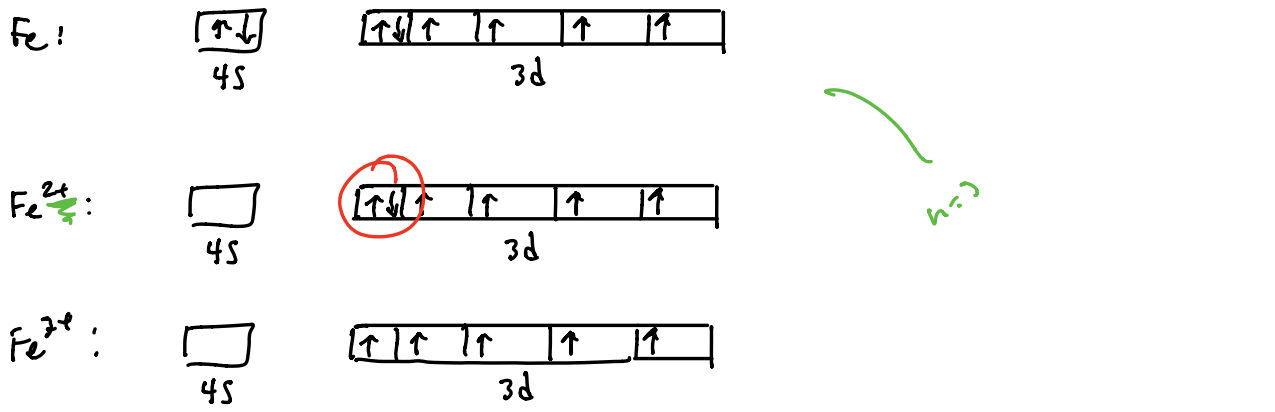
1







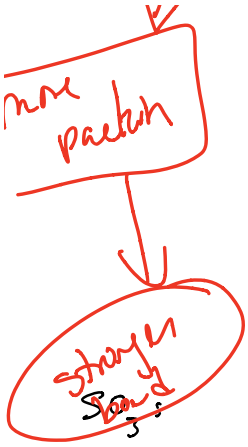




Large ions

Shapes, Polarity, forces, hybridization

Small ions



Carbon 2 or 3.
#v.e used = 20

v.e left = 24 - 20
= 4

distribute to most electronegative central atom first.

Tomorrow's activity:

* CO_2 linear
* H_2O bent